UNITED STATES DEPARTMENT OF AGRICULTURE
FARM CREDIT ADMINISTRATION
WASHINGTON, D. C.

MARKETING MAINE POTATOES

DAMAGE IN SELECTED BAGS AT MAINE SHIPPING POINTS AND IN BOSTON WHOLESALE AND RETAIL MARKETS

By
MAYNARD A. HINCKS
RAYMOND L. SPANGLER
and
GORDON W. SPRAGUE

COOPERATIVE RESEARCH AND SERVICE DIVISION
in cooperation with
AGRICULTURAL MARKETING SERVICE
and
MAINE AGRICULTURAL EXPERIMENT STATION

Miscellaneous Report No. 39 September 1941

FARM CREDIT ADMINISTRATION

A. G. Black - Governor

COOPERATIVE RESEARCH AND SERVICE DIVISION

T. G. Stitts - Chief
W. W. Fetrow - Associate Chief

CONCLUSIONS AND RECOMMENDATIONS

Most of the damage found in Maine potatoes inspected in Boston retail stores was present at the time they left the shipping point. Some additional damage was added in the process of distribution, mostly at the time of delivery to retail stores.

Most of the damage revealed by the inspections at shipping point was old mechanical injury. The increase in damage between the shipping point and the retail store was in the form of new mechanical injury.

Potatoes, particularly those packed in 15-pound paper bags, can be satisfactorily packed in Maine for the consumers' use, except for those occasional lots frozen in transit or out of grade as a result of condition factors not identifiable at the time of packing, provided: (a) More care is used to remove damage at shipping points, and (b) more care is used to prevent additional damage in later distribution. When they were carefully handled, these small packages showed much less increase in damage than the 100-pound burlap bags. If packed to a low percentage of damage at the shipping point, these packages could be delivered at the retail store with most of the desirable qualities intact. Since the bulk of the defective stock was found to be present in the packages before they left the shipping points, the answer to the question "Can potatoes be packed at shipping points in Maine and merchandised in Boston and other markets in such a way that desirable qualities present at Maine shipping points will be present when the potatoes are offered to consumers in retail stores?" is largely dependent upon the steps growers and shipping organizations take to improve the quality of the potatoes they load for shipment.

Tolerances were provided in the U. S. standards for potatoes because of the difficulty of doing a perfect job of sorting out defective tubers under commercial practices. Furthermore, the cost of trying to attain perfection in sorting and grading would likely be so high as to put the product at a disadvantage on a price basis. It is believed, however, that growers and shippers could materially improve the general quality of the potatoes offered for sale without very much additional cost.

The need for improvement in quality, as shown by the study, applies particularly to lots of potatoes packed in consumer packages. A program for such improvement might well embrace two objectives on the part of shippers and marketing organizations. First, aim to pack the product well within the limit of tolerances as permitted in the U. S. standards, and second, standardize the various carlots as well as the packages within the carlot so that the quality and size of the potatoes contained therein will be as nearly uniform as possible. Packages should be marked to describe their contents adequately.

Sorting and grading equipment should be well lighted, and sorters should be closely supervised to see that defective tubers are eliminated from the pack. Finally, packed bags should be handled and loaded carefully in the car or truck to insure against additional mechanical injury.

Another line of approach in the improvement of quality of potatoes offered to consumers consists in doing everything possible to hold mechanical injury which may occur in the process of distribution to a minimum. If the shipping organization controls distribution, it should insist on careful handling on the part of employees. If control of distribution passes into the hands of receivers in the markets, there is little that growers can do to see that truckers and handlers use care. Some wholesale receiv-

ers in Bostoh recognize the importance of careful handling and devote considerable time and effort to the problem of control of damage.

Growers should seek the cooperation of the Inspection Service in a marketing program which would:

a. Reduce the average percentage of damage in lots

b. Reduce the amount of variation in percentage of damage between lots

c. Reduce the variation in percentage of damage in bags in the same lot

To accomplish these ends, growers should investigate the possibility of gaining more control of practices in handling after the potatoes have left the shipping point.

DAMAGE IN SELECTED BAGS AT MAINE SHIPPING POINTS AND IN BOSTON WHOLESALE AND RETAIL MARKETS

By

Maynard A. Hincks
Assistant Agricultural Economist
MAINE AGRICULTURAL EXPERIMENT STATION

Raymond L. Spangler
Agricultural Economist
AGRICULTURAL MARKETING SERVICE

and

Gordon W. Sprague
Senior Agricultural Economist
FARM CREDIT ADMINISTRATION

CONTENTS

A study was made in retail stores in the Boston metropolitan area during March and early April of 1940 in which potatoes were examined to determine their quality as represented by standards for the grade U. S. No. 1. A considerable percentage of the bags of potatoes contained damage in excess of the 6-percent tolerance permissible under the standards for that grade. 1/

The results of these inspections are summarized in table 1. They show that in the retail stores, 41.0 percent of the 100-pound burlap bags of potatoes marked U. S. No. 1, 39.0 percent of the 15-pound branded bags marked U. S. No. 1, and 65.0 percent of the bags without grade identification contained more than 6 percent of damaged potatoes and could not be classified as U. S. No. 1.

Research conducted by interviews with Boston consumers during March and early April of 1940 indicated that consumers objected to damaged potatoes, as defined in

---

1/ *For more detailed discussion see Mumford, H. W. Jr., Marketing Maine Potatoes: Retail distribution of potatoes in the Boston Metropolitan Area, March 1940. Cooperative Research and Service Division, Farm Credit Administration, in cooperation with the Maine Agricultural Experiment Station, F.C.A. Misc. Rept. 26, 42 pp. (processed) 1940.*

TABLE 1. SUMMARY OF INSPECTION OF POTATOES IN 368 RETAIL STORES IN BOSTON, MARCH 1940: PERCENTAGE OF PACKAGES GRADING U. S. NO. 1 OR CONTAINING VARIOUS PERCENTAGES OF U. S. NO. 1 QUALITY

Package	U. S. No. 1	Percentage of U. S. No. 1 quality				U. S. No. 1 except for soft rot	Total	Under weight	Total packages
		89-94	83-88	75-82	Less than 75				
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
100-pound burlap bags marked U. S. No. 1	59	22	13	4	2	0	100	31	230
15-pound branded packages marked U. S. No. 1	61	28	8	2	1	1/	100	5	445
Store packages without grade identification	35	39	12	9	4	1	100	2/	129

1/ *Less than 1/2 percent.*

2/ *Not available.*

the U. S. standards for No. 1 grade. Table 2 shows that about 43 percent of the consumers selected as objectionable the same potatoes picked out by trained potato inspectors. About 35 percent of these consumers were less critical of the potatoes than were the inspectors, and about 22 percent were even more critical than the inspectors. These data show that it is important from the point of view of producers and their marketing organizations that damaged potatoes in retail bags be held to a minimum. Since consumers recognized this damage and objected to it, potato producers should interest themselves in the reasons for such high percentages of defective tubers in the retail bags, and organize their marketing procedures in such a way as to limit them wherever feasible.

REASONS FOR THE PRESENT STUDY

Potato growers and shippers in Maine requested that additional research be undertaken to determine the kind of damaged potatoes present in retail bags and the point in the distribution process where this damage originated. As a result of these requests, the present study was undertaken for the purpose of answering the following questions:

1. What were the defects, in order of their importance, that accumulated in the bag in the process of distribution from the shipping point to the retail store in Boston?

2. What were the causes of damage, and at what points in the distribution process did damage occur?

3. Can potatoes be packed at shipping points in Maine and merchandised in Boston and other markets in such a way that desirable qualities present at Maine shipping points will be present when the potatoes are offered to consumers in retail stores?

TABLE 2. COMPARISON OF DEFECTS IN POTATOES FOUND BY HOUSEWIFE AND INSPECTOR IN BRANDED PECK AND BULK STOCK PURCHASES, BY SAMPLING PERIODS - BOSTON, MARCH AND JUNE 1940 [1/]

Sampling period	Crop	Branded pecks					Packages for bulk lots				
		Total families reporting	Percentage defects found by housewife as compared with those found by the inspector			Total	Total families reporting	Percentage defects found by housewife as compared with those found by the inspector			Total
			More	Less	Same			More	Less	Same	
		Number	*Percent*	*Percent*	*Percent*	*Percent*	*Number*	*Percent*	*Percent*	*Percent*	*Percent*
March 4-March 23	[2/]	149	39.6	28.2	32.2	100.0	255	34.9	25.1	40.0	100.0
March 25-April 6	[2/]	110	23.6	24.6	51.8	100.0	255	17.3	19.2	63.5	100.0
June 1-June 15	old	43	11.6	39.5	48.9	100.0	144	16.0	45.8	38.2	100.0
June 1-June 15	new	-	-	-	-	-	58	6.9	65.5	27.6	100.0
June 17-June 29	old	25	16.0	52.0	32.0	100.0	57	8.8	71.9	19.3	100.0
June 17-June 29	new	-	-	-	-	-	101	4.0	62.4	33.6	100.0
Total		327	28.7	30.3	41.0	100.0	870	19.4	36.9	43.7	100.0

[1/] *These data do not include packages in which neither the consumer nor the inspector found any defects.*

[2/] *No new potatoes included in March and April.*

METHOD AND PROCEDURE

It was concluded that the above questions could best be answered by analyzing and determining the quality of individual packages of potatoes packed for shipment at Maine shipping points, then reexamining and determining the quality of the potatoes in the same bags upon arrival at the Boston wholesale dealers' establishments and again as they were offered to consumers in the retail stores.

The work was conducted jointly by the Maine Agricultural Experiment Station, the Agricultural Marketing Service of the U. S. Department of Agriculture, and the Cooperative Research and Service Division of the Farm Credit Administration, U. S. Department of Agriculture.

Experienced Federal-State potato inspectors provided by the Agricultural Marketing Service were employed to inspect the potatoes and gather data. Packages were selected from cars that were to be billed to wholesalers and chain-store organizations in Boston. All carlots were represented as grading U. S. No. 1. Packages of potatoes were analyzed from 41 cars loaded at the following shipping points in Maine: Caribou, Presque Isle, Easton, Limestone, New Sweden, Van Buren, Fort Fairfield, and Washburn.

An effort was made to inspect the contents of 20 bags in each car loaded with 100-pound bags and the contents of 30 packages in each car loaded with consumer packages. 2/ Inspections at the shipping point were made either in the car or just prior to loading. All the potatoes in each bag were examined individually. No potatoes were cut to determine the presence of net necrosis or other concealed defects. All tubers showing external damage in each package were sorted out, weighed, and the percentage of such damage recorded. These damaged potatoes were then replaced with nondefective tubers. Thus, each potato in each bag analyzed supposedly met U. S. No. 1 requirements at the shipping point.

A serial number was attached to each bag of potatoes examined so that it could be identified when unloaded at the Boston wholesale market and in the retail store. Since the bags were supposedly free from damaged potatoes when loaded in Maine, any damage, except rot or other similar deterioration, found subsequently in the same packages was assumed to result from handling practices in the distribution process.

Some expressed concern at first over the use of "marked sample" bags, fearing the possibility of "special" or "exceptional" care in handling. Although there may have been some special handling, it probably did not affect the results materially since:

1. The wholesalers in general desire careful handling, to reduce complaints and bags returned from customers, and continually emphasize the importance of careful handling to their employees.

2. Men who have handled potatoes in Boston for years were not likely to change their habits quickly, and even if the handlers did use more care at the outset, unless constantly prompted, slipped back to their usual practices.

3. The data gathered under the procedure as outlined were so similar to that gathered a year earlier, that there was no strong evidence of bias due to special handling.

In the wholesale receiver's warehouse, the inspector recorded the percentage of tubers that had become damaged after the bags left the shipping point. These

---

2/ *All consumer packages except 10 contained 1 peck, or 15 pounds. In the tables and discussion they will be referred to as 15-pound bags.*

potatoes were not discarded as at the shipping point, but were returned to the bags. The inspectors at the retail stores also recorded the percentage of damage that occurred after the bags left the shipping point.

During the period of the study, a total of 1,027 bags of potatoes taken from 41 cars were analyzed at Maine shipping points. Of these, 715 were consumer packages taken from 23 straight cars and 3 cars of mixed sizes, and 312 were 100-pound bags taken from 15 straight cars and the 3 cars of mixed sizes.

spectors, however, made examinations of 781 of the original packages in retail stores.

The percentage loss may be summarized as follows:

185 bags, or 18.01 percent, between Maine and the wholesale markets

61 bags, or 5.94 percent, between wholesale markets and retail stores

Total 246 bags, or 23.95 percent, between Maine and the retail stores, or roughly, 1 bag out of each 4 originally inspected.

TABLE 3. QUALITY OF POTATOES INSPECTED AT MAINE SHIPPING POINTS, FEBRUARY 26 TO APRIL 9, 1941

Container	U. S. No. 1		U. S. No. 1 except for soft rot		88 to 94 percent U. S. No. 1		87 percent or less U. S. No. 1		Totals	
	Number bags	*Percent*	*Number bags*	*Percent*	*Number bags*	*Percent*	*Number bags*	*Percent*	*Number bags*	*Percent*
100-pound bags	68	85.9	11	3.5	33	10.6	-	-	312	100.0
15-pound bags	510	71.3	14	2.0	163	22.8	28	3.9	715	100.0

Although packages from 41 cars were inspected in Maine, 4 cars were diverted to other markets, thus making packages from 37 cars available for inspection in Boston. As a result of this and failure to find some packages, only 842 packages were finally reinspected at Boston wholesale establishments.

There was some further loss of packages in the distribution from wholesale to retail establishments. Frequently 25 to 30 sample packages were sent out on a truck as a part of a load to be delivered to several different retail stores, and the identity of some was lost. The in-

QUALITY OF POTATOES INSPECTED AT MAINE SHIPPING POINTS

The quality of the various varieties of potatoes inspected at Maine shipping points is indicated by the data in table 3. About 86 percent of the 100-pound bags contained potatoes that met the requirements of the U. S. No. 1 grade, whereas only about 71 percent of the 15-pound branded paper bags were packed with potatoes that met these grade requirements. Most of the remaining bags of all sizes contained potatoes that fell within a range of 88 to 94 percent U. S. No. 1 quality. 3/

3/ *The quality of potatoes reported in this study was probably higher than the average for Maine as a whole. Some cooperating shippers, for instance, were recognized leaders in the packing of high quality potatoes, and others may have offered their better cars for inspection.*

TABLE 4. PERCENTAGE OF DEFECTS BASED ON U. S. NO. 1 GRADE REQUIREMENTS AS FOUND IN BAGS OF POTATOES INSPECTED AT MAINE SHIPPING POINTS, FEBRUARY 25, TO APRIL 9, 1941

Container	Bags showing													
	No defects		2 percent or less		2.1 to 4 percent		4.1 to 6 percent		6.1 to 10 percent		Over 10 percent		Totals	
	No. bags	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*
100-pound bags	1	0.3	45	14.4	141	45.2	83	26.6	41	13.2	1	0.3	312	100
15-pound bags	101	14.1	100	14.0	190	26.6	131	18.3	151	21.1	42	5.9	715	100

It will be remembered that the sample bags of potatoes were taken from cars represented and mostly certified as U. S. No. 1 grade. At first it might appear that because about 14 percent of the 100-pound packages and about 29 percent of the smaller packages inspected contained more than the 6-percent tolerance for defective tubers, some cars could not properly be classified or represented as U. S. No. 1. This is not true, however, because in applying the tolerances as provided in the U. S. standards for potatoes, some packages in a lot are permitted to have double the tolerance for defects and one-tenth of the packages may exceed this amount, provided the average for all packages does not exceed the 6-percent tolerance. In other words, a car of U. S. No. 1 potatoes may have some packages with as high as 12 percent defects (double the tolerance) and 1 package in 10 may exceed this percentage, provided the average of all packages does not exceed 6 percent. Further restrictions on soft rot or wet breakdown are provided in the U. S. standards, but lots of potatoes may have some packages containing up to 2 percent of such defects (double the tolerance); and 1 package in 10 may have as much as 4 percent, provided the average for all packages does not exceed 1 percent.

Thus the data given in table 3 afford no basis for assuming that the cars were misrepresented or improperly certified. None of the 100-pound packages exceeded double the tolerance for defects, and only 4 percent of the consumer-sized bags exceeded this amount.

A summary of the percentages of defects based on U. S. No. 1 grade requirements, as found in the bags of potatoes inspected at the various Maine shipping points, is shown in table 4. It is surprising to note that, in general, the quality of the potatoes packed in 100-pound packages is somewhat superior to that of the potatoes packed in the consumer-sized packages. Whereas the smaller packages showed a higher percentage with no grade defects than the 100-pound packages, they also showed a considerably higher percentage with defects exceeding the 6-percent tolerance permitted in U. S. No. 1 grade. Actually the potatoes in 193 of the smaller packages, or about 27 percent, were not U. S. No. 1 grade when they left the shipping point as compared with about 13 percent of the 100-pound bags.

The results of these inspections indicate that Maine shippers are not giving enough attention to the sorting out of defective tubers, particularly those packed in consumer packages. With 1 package out of 4 below grade before leaving shipping points, it is safe to assume that a larger percentage were below grade owing to transit and handling damage when the packages finally reached the retail stores and

TABLE 5. TYPE AND PERCENTAGE OF DEFECTS BASED ON U. S. NO. 1 GRADE REQUIREMENTS AS FOUND IN BAGS OF POTATOES INSPECTED AT MAINE SHIPPING POINTS, FEBRUARY 25 TO APRIL 9, 1941

Type of defect and container	Bags showing						Totals	
	No defects	2 percent or less	2.1 to 4 percent	4.1 to 6 percent	6.1 to 10 percent	Over 10 percent		
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number bags*	*Percent*
Soft rot and wet breakdown:								
100-pound bags	87.2	11.2	1.6	-	-	-	312	100
15-pound bags	97.8	1.7	0.5	-	-	-	715	100
Dry rot and late blight:								
100-pound bags	62.5	36.9	0.6	-	-	-	312	100
15-pound bags	90.5	6.7	2.5	0.3	-	-	715	100
Digger cuts:								
100-pound bags	85.3	14.7	-	-	-	-	312	100
15-pound bags	97.2	2.0	0.6	0.1	0.1	-	715	100
Old mechanical injury:								
100-pound bags	3.8	48.1	40.4	7.1	0.6	-	312	100
15-pound bags	32.3	22.1	24.8	10.8	8.9	1.1	715	100
Scab:								
100-pound bags	67.6	30.2	2.2	-	-	-	312	100
15-pound bags	82.0	10.1	5.5	2.1	0.3	-	715	100
Sunburn:								
100-pound bags	31.7	55.8	11.5	1.0	-	-	312	100
15-pound bags	81.4	9.6	6.7	1.5	0.8	-	715	100
Misshapen:								
100-pound bags	70.2	28.8	1.0	-	-	-	312	100
15-pound bags	89.2	4.3	5.3	0.4	0.7	0.1	715	100
Growth cracks:								
100-pound bags	83.3	16.7	-	-	-	-	312	100
15-pound bags	96.2	3.5	0.1	0.1	0.1	-	715	100

that the percentage of defects increased in those packages not already up to grade.

TYPE OF DAMAGE FOUND AT MAINE SHIPPING POINTS

Further information as to the kind and extent of defects based on U. S. No. 1 grade requirements, as found in the 1,027 bags inspected at Maine shipping points, is shown in table 5. The potatoes were not cut for concealed defects, hence the table does not include percentages for such defects as hollow heart, net necrosis, or the various types of rot, unless apparent from the outside condition of the potato, nor such frost injury as would not indicate its presence by external appearance.

The data given in table 5 and other information with reference to size and type of defects taken from the inspection records may be summarized as follows:

100-POUND BAGS

Undersize -

None of the bags inspected in Maine were found to be out of grade because of undersized potatoes.

Second growth -

Only 4 bags contained potatoes with this defect but not in sufficient amount to impair the quality as to grade.

Soft rot or wet breakdown -

About 87 bags in each 100 contained no potatoes affected by soft rot.

About 9 bags in each 100 contained less than 1 percent.

About 4 bags in each 100 contained 1 percent or more.

The tolerance for the U. S. No. 1 grade does not permit this defect in excess of 1 percent.

Dry rot and late blight -

About 62 bags in each 100 contained no potatoes damaged by dry rot.

About 37 bags in each 100 contained 2 percent or less.

Less than 1 bag in each 100 contained more than 2 percent.

No bags contained potatoes that were out of grade because of this defect in itself.

Digger cuts -

About 85 bags in each 100 contained no potatoes damaged because of digger cuts.

About 15 bags in each 100 contained 2 percent or less.

No bags contained potatoes that were out of grade because of digger cuts alone.

Old mechanical injury -

About 4 bags in each 100 contained no defective potatoes because of mechanical injury.

About 48 bags in each 100 contained 2 percent or less.

About 40 bags in each 100 contained 2.1 to 4 percent.

About 7 bags in each 100 contained 4.1 to 6 percent.

Only 1 bag in the lot was out of grade because of this defect alone.

Scab -

About 68 bags in each 100 contained no potatoes damaged because of scab.

About 32 bags in each 100 contained less than 4 percent.

Scab of itself did not cause any bags to go out of grade.

Sunburn -

About 32 bags in each 100 contained no potatoes damaged because of sunburn.

About 56 bags in each 100 contained 2 percent or less.

About 12 bags in each 100 contained 2.1 to 6 percent.

No bags contained potatoes with more than 6 percent of this defect.

Misshapen -

About 70 bags in each 100 contained no misshapen potatoes.

About 29 bags in each 100 contained 2 percent or less.

About 1 bag in each 100 contained 2.1 to 4 percent.

No bags contained enough misshapen potatoes to cause it to exceed the tolerance for the grade.

Growth cracks -

About 83 bags in each 100 contained no potatoes damaged by growth cracks.

About 17 bags in each 100 contained 2 percent or less.

No bags were out of grade because of this defect in itself.

15-POUND BAGS

Undersize -

Only 6 bags exceeded the tolerance of 5 percent for U. S. No. 1 grade in this respect.

Soft rot and wet breakdown -

There were 16 bags or 2.2 percent that were out of grade because of this defect.

Second growth -

No bags contained potatoes damaged because of this defect.

Dry rot and late blight -

About 90 bags in each 100 contained no potatoes damaged by dry rot.

About 7 bags in each 100 contained 2 percent or less.

About 3 bags in each 100 contained 2.1 to 6 percent.

This defect was not present in any bag in excess of 6 percent.

Digger cuts -

About 97 bags in each 100 contained no potatoes damaged by digger cuts.

About 2 bags in each 100 contained 2 percent or less.

About 1 bag in each 100 contained more than 2 percent.

One bag in the entire lot was out of grade because it contained more than the 6 percent tolerance.

Old mechanical injury -

About 32 bags in each 100 contained no defective potatoes because of mechanical injury.

About 22 bags in each 100 contained 2 percent or less.

About 25 bags in each 100 contained 2.1 to 4 percent.

About 11 bags in each 100 contained 4.1 to 6 percent.

About 10 bags in each 100 contained more than 6 percent.

Old mechanical injury was fairly well distributed throughout the various percentages represented. This defect is the most prevalent of all defects, and is the primary reason why many bags were out of grade at shipping point.

Scab -

About 82 bags in each 100 contained no potatoes damaged by scab.

About 10 bags in each 100 contained 2 percent or less.

More than 5 bags in each 100 contained 2.1 to 4 percent.

More than 2 bags in each 100 contained 4.1 to 6 percent.

Three bags out of the entire lot had more than 6 percent of potatoes damaged by scab. The presence of scabby potatoes in a bag greatly detracts from the appearance of the lot, and they are objectionable to consumers. Since affected tubers can be rather easily sorted out, they should be eliminated from the pack insofar as possible.

Sunburn -

About 81 bags in each 100 contained no potatoes damaged by sunburn.

About 10 bags in each 100 contained 2 percent or less.

About 7 bags in each 100 contained 2.1 to 4 percent.

About 2 bags in each 100 contained more than 4 percent.

Six bags of the 715 bags inspected contained damaged tubers in excess of the 6 percent tolerance permitted for the grade. Sunburn is objectionable because it detracts from the appearance and impairs the eating quality of the potatoes. The elimination of potatoes with this defect would aid the general quality of any lot of potatoes. Affected potatoes are difficult to sort out, particularly if they are dirty; but it appears that their presence in 1 bag out of 5 inspected was higher than necessary if extreme care had been used in sorting.

Misshapen -

About 89 bags in each 100 had no misshapen potatoes.

About 5 bags in each 100 had 2 percent or less.

About 5 bags in each 100 had 2.1 to 4 percent.

About 1 bag in each 100 had 4 percent or more.

There were 6 bags out of the 715 bags inspected that contained more than 6 percent of misshapen potatoes. They seemed to be more prevalent in the Green Mountain variety. The general opinion of tradesmen

TABLE 6. PERCENTAGE OF DAMAGE BY MECHANICAL INJURY OCCURRING IN BAGS OF POTATOES DURING TRANSIT FROM MAINE SHIPPING POINTS AND UNLOADING OPERATIONS IN BOSTON WHOLESALE MARKETS, FEBRUARY 25 TO APRIL 9, 1941

Container	Bags showing -												Totals	
	No damage		2 percent or less		2.1 to 4 percent		4.1 to 6 percent		6.1 to 10 percent		Over 10 percent			
	No. bags	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*
100-pound bags	87	33.7	144	55.8	19	7.4	6	2.3	2	0.8	-	-	258	100
15-pound bags	533	91.3	31	5.3	7	1.2	7	1.2	4	0.7	2	0.3	584	100

is that the type of Green Mountain potatoes has undergone a change.

Growth cracks -

About 96 bags in each 100 had no growth cracks.

About 4 bags in each 100 had 2 percent or more.

Only 1 bag out of the 715 bags inspected contained more than 6 percent of potatoes with this defect. It was of very little consequence as a factor in lowering the quality of the potatoes inspected.

DAMAGE OCCURRING BETWEEN SHIPPING POINTS AND BOSTON WHOLESALE WAREHOUSES

The wholesale warehouse inspections in Boston were made after the sample bags were unloaded and stacked. In the operations of one chain store, however, this procedure was varied, since cars were unloaded directly into trucks for distribution to retail stores. In this instance, inspections were made at the car on the railroad siding.

All damaged potatoes were removed from the bags at the time of shipping-point inspection, so that any damage found upon reinspection in Boston could be assumed to have occurred after leaving Maine. The damage found at the time of unloading in Boston was attributable mostly to the transportation and unloading operations and was classified as new mechanical injury. The results of these inspections are shown in table 6 and are summarized as follows:

100-POUND BAGS

About 34 bags in each 100 acquired no damage.

About 56 bags in each 100 acquired 2 percent or less damage.

About 7 bags in each 100 acquired 2.1 to 4 percent damage.

About 2 bags in each 100 acquired 4.1 to 6 percent damage.

About 1 bag in each 100 acquired 6 percent or more damage.

The average amount of damage per 100-pound bag that occurred during transit and unloading operations was 0.96 percent.

15-POUND BAGS

About 91 bags in each 100 acquired no damage.

About 5 bags in each 100 acquired 2 percent or less damage.

About 2 bags in each 100 acquired 2.1 to 4 percent damage.

About 1 bag in each 100 acquired 4.1 to 6 percent damage.

About 1 bag in each 100 acquired 6 percent or more damage.

The average damage per 15-pound bag that occurred during transit and unloading operations was 0.24 percent.

DAMAGE FOUND AT RETAIL STORES

Since all damaged potatoes found at shipping points were removed and replaced with potatoes free from defects, all defects found on potatoes at the time of the retail-store inspection were caused by handling in the distribution process. This included shipment via rail to Boston, unloading into the warehouse, [4/] reloading into trucks immediately or some time later for trucking to retail stores, and finally unloading and piling at the retail store.

Table 7. Percentage of damage by mechanical injury occurring in bags of potatoes between Maine shipping points and arrival in Boston retail stores, February 25 to April 9, 1941

Container	Bags showing -												Totals	
	No damage		2 percent or less		2.1 to 4 percent		4.1 to 6 percent		6.1 to 10 percent		Over 10 percent			
	No. bags	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*	*No. bags*	*Per-cent*
100-pound bags	11	5.1	129	59.7	48	22.2	18	8.3	8	3.8	2	0.9	216	100
15-pound bags	390	69.0	47	8.3	54	9.6	22	3.9	33	5.8	19	3.4	565	100

Since all potatoes with visible defects were removed in Maine, the only defects that were expected were new mechanical injury, rots of various kinds that developed in transit, and frost injury. Actually the only damage found by the inspectors was classified as new mechanical injury, attributable entirely to handling. The results of the tabulations of such damage found in retail stores are shown in table 7.

The summary of retail-store inspections was as follows:

100-POUND BAGS

About 5 bags in each 100 acquired no damage.

About 60 bags in each 100 acquired 2 percent or less of damage.

About 22 bags in each 100 acquired 2.1 to 4 percent of damage.

About 8 bags in each 100 acquired 4.1 to 6 percent of damage.

About 5 bags in each 100 acquired 6 percent or more of damage.

The average amount of damage per 100-pound bag was 2.08 percent.

15-POUND BAGS

About 69 bags in each 100 acquired no damage.

About 8 bags in each 100 acquired 2 percent or less damage.

About 10 bags in each 100 acquired 2.1 to 4 percent damage.

About 4 bags in each 100 acquired 4.1 to 6 percent damage.

About 9 bags in each 100 acquired 6 percent or more damage.

The average extent of damage per 15-pound bag was 1.4 percent.

As shown by these data, the potatoes in the consumer packages sustained much less damage in the handling and distribution operations from Maine shipping points to retail stores than potatoes packed in 100-pound bags. The increased mechanical injury between unloading in Boston and ar-

[4/] *Except that 1 retail chain unloaded cars directly into trucks for delivery to retail units.*

rival at retail stores was greater to the potatoes in 100-pound bags than to those in the smaller packages. About a third of the 100-pound packages showed no damage to the potatoes by mechanical injury at the time of unloading at the wholesale warehouse, whereas upon arrival at the stores only 5 percent were free from such injury. On the other hand, about 71 percent of the consumer packages had potatoes free from damage at the time of unloading at the wholesale establishments, and 69 percent were free from such damage upon arrival in the stores, thus showing relatively little increase.

TOTAL DAMAGE IN RETAIL STORES

It is of interest to know what the percentage of the damaged potatoes in retail stores would have been had such damage found at shipping point not been removed. To find this figure, the percentage of damaged potatoes found at retail stores was added to that found at the shipping point. The results are shown in table 8. It is recognized that these data may show a slightly higher percentage of total defective tubers at retail stores than would actually have resulted, because some of the new mechanical injury might have occurred to tubers already damaged. However, there may have been some unusual care in handling the marked bags, thus offsetting the tendency to overemphasis from this treatment of the data. Therefore, it is believed that the retail store inspections plus those at shipping point show the approximate quality of potatoes that the retailer would have received if the defective potatoes had not been removed at the shipping points.

Comparison of the quality of 781 bags of potatoes inspected at shipping points and in the retail stores shows that there was considerable lowering of quality during the distribution period. As shown in table 8, only 12.5 percent of the 100-pound packages failed to grade U. S. No. 1 at shipping point; whereas, in the retail stores, almost 40 percent of the same packages failed to meet grade requirements. The increase in handling damage to potatoes in most of the 15-pound packages, however, was less pronounced. About 26 percent of these packages were packed with potatoes that failed to meet U. S. No. 1

TABLE 8. COMPARISON OF PERCENTAGES OF DEFECTS FOUND IN 781 BAGS OF POTATOES INSPECTED AT MAINE SHIPPING POINTS PLUS THE PERCENTAGES FOUND AT BOSTON RETAIL STORES, FEBRUARY 25 TO APRIL 9, 1941

Container and place of inspection	Bags showing -						Totals	
	No defects	2 percent or less	2.1 to 4 percent	4.1 to 6 percent	6.1 to 10 percent	Over 10 percent		
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number bags*	*Percent*
100-pound bags at shipping point	0.5	15.3	45.8	25.9	12.5	-	216	100
100-pound bags at retail stores	-	4.6	23.7	31.9	29.6	10.2	216	100
15-pound bags at shipping point	14.9	14.9	27.6	16.8	21.4	4.4	565	100
15-pound bags at retail stores	11.2	10.8	20.9	17.5	26.5	13.1	565	100

TABLE 9. AVERAGE PERCENTAGE OF DEFECTS OR DAMAGED POTATOES PER BAG FOUND AT EACH OF THE THREE INSPECTION POINTS, FEBRUARY 25 TO APRIL 9, 1941

Size of bag (Pounds)	Place of inspection			Total
	Shipping points	Boston wholesale warehouses	Boston retail stores 1/	
	Percent	*Percent*	*Percent*	*Percent*
100	3.92	0.96	2.08	6.00
15	4.20	0.24	1.40	5.60

1/ *Includes defects recorded at wholesale warehouse.*

grade requirements at shipping points and an additional 14 percent of the packages, making a total of 40 percent, were below grade upon arrival at the stores in Boston. It is significant that the results of these analyses compare very closely with those made in the spring of 1940, when it was found that about 40 percent of the packages of potatoes supposedly packed to meet U. S. No. 1 grade requirements at shipping points were below grade upon arrival in the retail stores (table 1).

The average percentages of defects found in the two types of packages at the various points of inspection are shown in table 9. The average damage that occurred to the potatoes in rail transit from Maine shipping points to the Boston wholesale establishments was comparatively slight; a little less than 1 percent in the case of those packed in 100-pound bags and about 0.25 percent of those packed in smaller packages.

The largest proportion of the damage sustained by both types of containers after inspection at shipping point, (54 percent for 100-pound bags and 83 percent for the smaller bags), occurred in the movement from the wholesale warehouse to the retail stores. Although the average percentage of damage that occurred during this phase of distribution is higher for potatoes packed in consumer packages than for those packed in 100-pound bags, it should be mentioned that this was caused by excessive damage to the potatoes in a few packages as is shown in table 8.

The average damage per 100-pound bag, 2.08 percent, found at the retail stores, when added to the average of defects found in these same bags in Maine, 3.92 percent, shows that these 100-pound bags would have contained an average of 6 percent total defects when offered to the consumers in the retail stores.

The 15-pound bags sustained an average of 1.4 percent of defective potatoes in distribution from Maine to the retail stores. If this amount is added to the 4.2 percent of defects found to be the average per consumer bag in Maine, these bags would have contained an average of 5.6 percent of total defects.

The fact that the 100-pound bags, on the whole, contained fewer defects in Maine than the consumer bags but sustained more damage in transit to the retail stores may have been attributable to:

1. Inability to handle the heavier bags with the same care as the smaller units.
2. Necessity for greater care in handling potatoes packed in paper bags.
3. Greater protection to the potatoes afforded by paper bags.

No effort was made to determine why the potatoes packed in 100-pound bags at

shipping point contained fewer defects than those packed in peck bags.

SOME CAUSES OF DAMAGE IN DISTRIBUTION

The small amount of damage occurring to potatoes in both 100-pound bags and 15-pound bags in transit from Maine to Boston was due primarily to shifting in the car. Such damage does not show up as readily in burlap bags as it does in paper bags, which may develop holes at the point of chafing.

In unloading a car of 100-pound bags of potatoes, a hand truck is used, on which bags are piled four or five at a time. This means that the bottom bag is being subjected to rough usage, since it rests upon the tongue of the truck and has a bearing at only two narrow points along its length. This causes some damage. The 15-pound bags are handled more carefully, since racks are usually placed on the tongue of the truck.

Piling in the warehouse improperly can cause damage. There is a tendency to pile both types of bags too high when warehouse space is crowded.

Dropping the 100-pound bags from shoulder height is a common cause of damage. This is particularly true in cold weather when potatoes are more likely to crack.

Throwing the bags is another cause of damage. This is a common method of handling between workers in piling or moving the smaller bags. In piling, these small bags are commonly slammed into the pile for the purpose of making them stay where desired.

Several peck-size paper bags of potatoes were examined after they had been allowed to fall 3 to 4 feet, and in each case about 25 percent of the potatoes within the bag suffered damage by being either broken, split, or bruised.

Another common practice is to walk on bags of potatoes in a car. This observation has been made both in Maine and in Boston. While no actual calculations were made of damage so caused, it is safe to assume that some damage occurred. In any case, it is a practice which cannot be termed, "careful handling."

Another observation made at shipping point in several warehouses was the practice of unloading potatoes in freezing weather at the warehouse and running the potatoes over the grading equipment into bags and then into cars for immediate shipment, risking the appearance of frost injury later when these potatoes became warm in the car.

Most of the damage between Maine shipping points and the retail stores occurred between the wholesale warehouse and the store. At this point the potatoes passed from the control of the wholesale receiver into the hands of employees or truckmen.

Dropping or tossing of bags of potatoes from platform to truck, piling on crates of other merchandise, poor piling which later results in bags falling from the load, or dragging bags along the floor and into the truck all contributed to increased damage.

Unloading at retail stores by dropping through the basement window, dropping other merchandise crated or bagged on the potatoes, sliding potatoes and other packages into the basements of stores, piling crates on top of potatoes in the storage room, and walking over the potatoes are all factors that contribute to increased damage.

Burlap prices were higher than usual in 1941, which resulted in the use of some of the cheaper grades of burlap bags. These cheaper bags stretched when filled with potatoes, especially if the original sewing was not tight, and as a result the potatoes were given more freedom of movement within the bag. Such looseness of the bag is likely to cause more chafing and consequently more damage.

The damage to the smaller 15-pound units was less than the damage to potatoes packed in the 100-pound bags. The paper

bag, while durable under normal handling conditions, may be torn or unfastened by rough handling. The most persistent objection to paper bags lies in their inability to withstand moisture, usually occasioned by frost or rot.

In general, the causes of damage are well known. Elimination of these causes is usually dependent upon the individual who handles the potatoes. Educational campaigns would probably have little, if any, effect upon the persons responsible for most of the damage that occurs through rough handling.

STANDARDIZATION IN A MARKETING PROGRAM

If a marketing organization represents growers who are interested in the reputation of their product, a program of grading and standardization can be developed with that end in view. Such a program should embrace two objectives in packing. The first is packing to a low limit of tolerance. The second is making the contents of each bag as nearly as possible like every other bag, thereby providing a higher degree of standardization within the lots. When these two objectives have been reached, buyers - whether dealers or consumers - can buy with confidence. A marketing organization which has achieved a reputation for low percentage of damage and standardization of bags within lots sold will find its markets expanded and selling costs reduced. In accomplishing these results, the services of the Federal-State Inspectors may be helpful.

The Federal grades are inclusive enough to provide a description of the contents of bags or lots under the various conditions of growing and marketing throughout the United States. They are useful as a basis for a marketing program for any specific area or for any marketing organization. Their use depends very largely on the program and policy of the marketing organization using them.

Tolerances are provided in the Federal grades in recognition of practical considerations in marketing. One of these is that growers in some producing areas are not equipped with warehouse and grading facilities with which to grade and standardize their product for marketing. Another is that the cost of a perfect job

TABLE 10. DISTRIBUTION OF DAMAGE IN BAGS OF POTATOES LOADED BY VARIOUS SHIPPERS AS INSPECTED AT MAINE SHIPPING POINTS

Shipper and bag	Number of bags	Percentage of bags damaged as indicated						
		None	2 percent or less	2.1 to 4 percent	4.1 to 6 percent	6.1 to 10 percent	10 or more percent	Total
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
In 100-pound bags:								
Number 1	40	0	0	47.5	50.0	2.5	0	100
Number 2	40	2.5	40.0	32.5	22.5	2.5	0	100
Number 3	87	0	4.6	49.4	25.3	20.7	0	100
In 15-pound bags:								
Number 1	100	12.0	22.0	25.0	10.0	24.0	7.0	100
Number 4	40	7.5	15.0	25.0	20.0	20.0	12.5	100
Number 5	150	13.3	12.7	25.3	26.0	19.3	3.4	100
Number 6	260	8.8	13.1	26.6	19.6	24.6	7.3	100

of sorting and grading would be so high as to put the product at a disadvantage on a price basis. A third is that in marketing a perishable product, some damage will result in the distribution process. Tolerances are therefore a necessary provision. Maximum tolerances, however, should be thought of as applying to the point of delivery, and not to the point of packing.

The data presented in tables 4 and 9 show that most of the damage was present in the packages inspected before they left the shipping point. With average damage at shipping point of about 4 percent and additional damage of about 2 percent accumulating in the marketing process, the average damage in the retail store was about 6 percent. Since these were averages, it follows that a large proportion of the packages included damage exceeding 6 percent.

The data show that too much damage was included at the shipping point. Two lines of approach are indicated. The first is the adoption of the policy of more careful sorting out of defective tubers in the packing process at the shipping point. Better lighting, more careful removal of dirt, and more careful attention on the part of employees sorting and grading would accomplish this result. With adequate sorting equipment, the cost would not be materially increased, except for those packers who operate their equipment at speeds so high as to make careful sorting impossible. Better equipment and more careful sorting would also reduce the wide variation in the contents of bags in the same lot. The second line of approach lies in more careful handling in marketing. The development of collective grower action such that the control of operations by producers included more of the distribution processes would help reduce damage due to careless handling.

Inspection records taken at Maine shipping points were summarized for each reporting shipper who provided records including 40 bags or more. The distribution of damage included in these packages is shown in table 10. The average damage for each shipper is shown in table 11. Shipper No. 2 packed fewer damaged potatoes in his 100-pound bags than did shippers 1 and 3. This inspection record indicates considerable care in selecting and sorting out damaged and undersized potatoes at the shipping point before allowing them to be packaged for shipment to markets. It is probable that there are shippers who pack their product with as much as or even more care than that indicated for shipper No. 2.

TABLE 11. AVERAGE DAMAGE IN BAGS OF POTATOES LOADED BY VARIOUS SHIPPERS AS INSPECTED AT MAINE SHIPPING POINTS

Shipper and bag	Bags damaged	Average percentage of damage
	Number	*Percent*
In 100-pound bags:		
Number 1	40	4.1
Number 2	40	2.7
Number 3	87	4.5
In 15-pound bags:		
Number 1	100	4.3
Number 4	40	5.1
Number 5	150	4.2
Number 6	260	4.9

The difference in these inspection records indicates that, from the point of view of Aroostook County as a whole, there is a great lack of standardization among individual shipper packages. The data indicate the need for closer supervision of grading by shippers and closer cooperation between shippers and the inspectors of the Federal-State Inspection Service for the purpose of standardizing packing practices among shippers.

Even greater standardization might be expected if the growers would sell their potatoes through a central marketing agency and deliver their products to the association for packaging and sale. By turning over the product to a single organiza-

tion for standardization purposes, much greater regularity in the percentage of damage likely to be found in the individual packages would probably result.

Inspection records taken at retail stores were further classified according to the agency making retail delivery. These data (table 12) indicate that potatoes reach retail stores with less damage when delivered by a retailer in his own truck or by a wholesale dealer than when delivery is performed for hire by an independent truck operator.

They also indicate that retailers and wholesale dealers, on the average, exercise more control over damage when they use their own delivery service than when they use hired service. This offers further support of the idea that growers should control their own marketing services if they want their product to receive favorable recognition on a quality basis.

Growers acting collectively can develop a favorable reputation for their product by using the services of the Federal-State Inspectors. The inspectors can assist in a program to remove all damage possible before shipment and also aid in other ways in securing a standardized product. When growers adopt a program of more uniform standardization of such factors as damage, size, cleanness, and brightness, they will find the services of inspection and grading more valuable; their product will enjoy a better reputation in the market places; their losses from unsatisfactory delivery will be reduced; and the cost of selling the product will be smaller.

TABLE 12. DISTRIBUTION OF DAMAGE IN BAGS OF POTATOES AT RETAIL STORES BY DELIVERING AGENCIES

Delivered by	Number of bags	Percentage of bags damaged as indicated					
		No damage	2 percent or less	2.1 to 4 percent	4.1 to 6 percent	More than 6 percent	Average percentage damage
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Retailer's truck							
100-pound bags	76	10.6	67.1	18.4	2.6	1.3	1.5
15-pound bags	56	69.6	8.9	12.5	3.6	5.4	1.1
Wholesaler's truck							
100-pound bags	81	2.5	64.2	23.5	7.3	2.5	1.9
15-pound bags	207	72.9	7.7	7.7	2.9	8.8	1.1
Independent truck operator							
100-pound bags	59	1.7	44.1	25.4	16.9	11.9	3.0
15-pound bags	302	66.2	8.6	10.3	4.6	10.3	1.4